NASA SCIENCE MISSION DIRECTORATE

Earth Science Division
Applied Sciences Program
Energy Management Program Element
FY2007-2011 Plan

FINAL DRAFT

Date: 11/6/2006

Expanding and accelerating the realization of economic and societal benefits from Earth system science, information, and technology

NASA Earth Science Division - Applied Sciences Program

Energy Management Program Element

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The Applied Sciences Program websites contain additional information about the program and this program element:

Applied Sciences Program:	http://science.hq.nasa.gov/earth-sun/applications
Energy Management Element:	http://science.hq.nasa.gov/earth-sun/applications/theme8.htm
Project Tracking & Reporting	http://aiwg.gsfc.nasa.gov

NASA Science Mission Directorate – Applied Sciences Program

Energy Management Program Element Plan: FY 2007 - 2011

I. Purpose and Scope

The NASA Applied Sciences Program collaborates with partner organizations to enhance the application of NASA Earth science research results to serve issues of national priority. The desired outcome is for partner organizations to use project results, such as prototypes and benchmark reports, to enable the sustained, operational use of Earth science products and enhance their decision support capabilities.

In the 21st century there are many challenges facing society such as clean water, adequate food supplies, human health, economic growth and expansion, and the preservation of the environment just to name a few. Solutions to many of these challenges are more easily achieved when affordable, reliable and secure energy supplies are available for the global community. Forecasts of long-term energy demand suggest multi-fold increases in world energy consumption during the 21st century, driven by expanding population and economic development. Well informed policies and management decisions regarding energy production and its efficient use are paramount to ensure sustainability and prosperity for all in the global community. These same policies and decisions also need to account for the impact of energy production and energy consumption on the environment and climate change.

In response, the Administration, through the establishment of the Climate Change Science Program (CCSP) and the Climate Change Technology Program (CCTP), has called for the focusing of U.S. efforts in addressing climate change and established the approach to support the nation and the global community with the science-based knowledge to manage the risks and opportunities of change in the climate and related environmental systems and the impacts on societal infrastructures, such as energy supply and demand.

Internationally, the Intergovernmental Panel on Climate Change (IPCC), established by the World Meteorological Organization (WMO) and the United Nations Environmental Programme (UNEP), assesses scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation across many elements of society. More specific to energy, UNEP's Energy Programme addresses the environmental consequences of energy production and use, such as global climate change and local air pollution and supports decision makers in government and the private sector to make better, more informed energy choices which fully integrate environmental and social costs. The Global Earth Observation System of Systems (GEOSS) identifies energy as one of its nine societal benefit areas. The Group on Earth Observations (GEO) was established by a series of three international summits. GEO includes 65 member countries, the European Commission, and 43 participating organizations working together to establish GEOSS. The International Energy Agency, among other national and international entities, has specific tasks to address GEOSS objectives for improving management of energy resources.

Federal Departments such as Energy, Interior, Agriculture, Commerce, and Transportation, and Agencies, such as the Environmental Protection Agency (EPA), have primary responsibilities in the United States for forming policies and regulations concerning energy production, efficient energy consumption and conservation, and the monitoring and regulation of impacts from these activities on the environment. There are numerous organizations within the Energy sector that provide information to improve the sector's operations and responses to policies and regulations. These same federal agencies, departments and sector organizations participate in an international community that seeks many of the same goals as are found in the U.S. sector and desire to benefit from experiences gained in U.S. programs to enable their own energy sectors.

Responding to NASA's 2006 Strategic Plan goal 3A, "Study Earth from space to advance scientific understanding and meet societal needs", NASA implements the Energy Management Program Element of the Applied Sciences Program by partnering with federal and private organizations to improve their decisions and assessments that impact the Energy sector. These improvements are enabled by leveraging the Earth System knowledge generated from research resulting from spacecraft observations and model predictions conducted by NASA and providing these as inputs to the decision support and scenario assessment tools used by partner organizations. The Energy Management Program Element focuses its efforts to provide for improved decisions and assessments for the following primary areas:

1. Impacts of climate change on the energy sector
2. Renewable energy
2. Energy efficiency
3. Long-term energy modeling and forecasting
4. Supply and load forecasting
5. Measurement and monitoring of CO2 and other greenhouse gases as it relates to the energy sector

The Element maintains alignment with Administration priorities, specifically the CCTP, CCSP, and US GEO. In addition, the element responds to the 2007-2009 GEO Work Plan goals on energy management.
The approach of the Energy Management Program Element is to develop information pathways from NASA spacecraft observations and Earth system modeling to decision support tools (DST) supporting energy demand and availability in industry, U.S. government entities, and international organizations. These entities require historical, near-real time, and forecasted environmental observations as inputs to the DST for management decisions and scenario assessments for policy. NASA works with its partners to identify the physical quantities provided by NASA observations and model predictions resulting from Earth science research, which are specifically selected, derived, and formatted to meet the needs of a specific DST. The Energy Management Program Element leverages the NASA Science Mission Directorate (SMD) observations and predictions produced from six research themes. The leveraged themes are:

1. Atmospheric Composition
2. Carbon Cycle and Ecosystems
3. Climate Change and Variability
4. Water and Energy Cycles
5. Weather
6. Earth Surface And Interior

Roadmaps for the Earth System Science Research themes are found in the Science Mission Directorate Research Plan located at the web address http://science.hq.nasa.gov.

To facilitate the approach of the Energy Management Program Element, a basic three-step process has been adopted in order to evaluate, verify and validate, and benchmark Energy Management Applications with its partners:

1. Evaluation Research: Study the overall energy field, identify various industry sectors, and identify the corresponding U.S. government agencies and/or international organizations that contribute to these sectors. Assess the field needs and as necessary, create and validate rapid prototype datasets that address those needs.
2. Partner: Make contact and build partnerships with prospective DST developers and data users in

U.S. government, international organization, or related industry. Increase exposure to industry sector and interact with industry engineers and scientists. Ensure that the end-user understands the information that is being provided.
3. Specialize: Interact with partners to develop prototype datasets to better meet the Energy Sector needs. Cultivate new users. Upgrade the capabilities and parameters as new spacecraft data, analysis results, and modeling results/techniques are developed and improved.

As an example, this process was applied to the solar and wind industries in the development of a highly successful web based solution called the Surface meteorology and Solar Energy (SSE) data set (http://eosweb.larc.nasa.gov/sse). To develop this data set, NASA climate researchers worked in partnership with the Department of Energy/National Renewable Energy Laboratory (DOE/NREL), Natural Resources Canada's CANMET Energy Technology Centre (NRCan/CETC-Varennes), and several small solar and wind companies to produce specific parameters needed by industry engineers. A direct link between the SSE website and CEDRL's renewable energy decision support system decision support system (DSS) called RETScreen (www.retscreen.net) enabled access for a broader user community. Since its inception, the SSE website has received nearly 2.5 million hits, 520,000 data document downloads and over 10,000 unique users.

The desired outcome of the Energy Management Program Element is for partner organization to use the project results, such as guidelines, prototypes and procedures as benchmarks for operational use and to enhance their management and decision-making capabilities with appropriate Earth system products and tools. This Energy Management Program Element plan describes the activities for a systematic approach to evaluate, verify, benchmark, and extend the use of Earth System science knowledge, data, and technology to support partners' energy-related decision support tools and management responsibilities.

II. Objectives: FY2007-2011

The overall purpose of the Energy Management Program Element is:

To improve the public and private capability for integrating Earth system observations and predictions into sound management of energy demand and availability which fully integrate environmental and social costs in America and throughout the world.

Towards this purpose, the Energy Management Program Element has the following goals:

1. Develop information pathways from NASA spacecraft observations and Earth system modeling to decision support tools (DSTs) supporting energy production and efficiency in industry, with other US government entities and with international organizations by interacting with partner agencies to benchmark NASA research datasets derived from analysis of historic and current NASA spacecraft observations and modeling predictions.

2. Improve partner agencies' capabilities to utilize need-based global information from predictive modeling and products from spacecraft data spanning from short to long-term concerning energy efficiency and energy production.

All National Applications Program Elements are aligned to the NASA 2006 Strategic Plan and the agency's objectives as expressed in the NASA Integrated Budget and Performance Document (IBPD) and the Performance Assessment Rating Tool (PART).

QI - II 2007

• Initiate ROSES 05 solicited investigations focused on space weather (P.I.- Hesse, GSFC) and United Nations Environmental Programme (UNEP) Solar and Wind Energy Resource Assessment (SWERA) (P.I. - Fosnight, USGS)

• Initiate bioenergy rapid prototyping experiment in collaboration with University of Nebraska and U.S. Department of Agriculture.

• Initiate regional impacts of climate change on energy sector rapid prototyping experiment (NASA GISS) investigating the utility of global climate change model output on energy sector decision support (e.g., solar and wind energy site placement, traditional energy supply and load forecasting)

• Continue participation in International Energy Agency task representing an international effort to benchmark and improve the estimation and prediction of solar energy resource information.

QIII - IV 2007

• Publish a peer-reviewed journal article summarizing the Battelle contract report on future priorities for the utilization of NASA spaceborne measurements and models in energy sector decision support.

• In association with Battelle, conduct a stakeholder's workshop assessing progress in the Energy Management program element and refining near-term goals and objectives.

• Participate in GEO Secretariat and GEO Energy Community of Practice activities including the drafting of a 5- and 10-year GEO energy strategic plan.

• Enhance collaboration with integrated assessment modeling community through venues such as the Stanford Energy Modeling Forum (EMF) through a presentation at an EMF conference.

• Evaluate application of NASA OCO measurements for applicability to energy management decision support.

Near-term Objectives (FY08-FY11)
2008

• Release an upgraded version of the existing SSE website to include meteorological (i.e., temperature, humidity, winds, cloudiness) and solar energy parameters at a true 1 degree latitude by 1 degree longitude resolution from improved satellite data analysis and modeling (e.g., CERES, FlashFlux). The SSE dataset is used in several renewable energy decision support systems.

• Provide a data set compatible with existing industry design packages to allow building engineers and architects to include in their design space, solar energy parameters needed to compute the ambient light

resources of buildings areas for the purposes of increasing energy efficiency.

• Evaluate application of NASA Glory and OSTM measurements for applicability to renewable energy (e.g., solar and wave energy) resource assessment.

• Publish at least three articles on energy management applications of NASA science, including at least one in a peer-reviewed journal.

• Verify, validate, and complete benchmark reports on performance of NASA science products from at least 4 sensors on NASA research spacecraft and models into at least 3 separate energy management issues or decision support tools.

2009

• Evaluate application of GPM and other products to serve energy management decision support tools (using OSSEs as appropriate)

• Develop and assess methods for providing meteorological and solar energy parameters from atmospheric forecasting models for energy sector applications. With partner agencies develop this forecasted information using atmospheric model output for short-term (1-2 day), mid-term (1 week – 15 day), and long-term (1 month to seasonal). Develop prototype forecasted information and demonstrate application with a partner agency DSS for at least two of these time scales.

• Publish at least four articles on energy management applications of NASA science, including at least two in peer-reviewed journals.

• Verify, validate, and complete benchmark reports on performance of NASA science products from at least 5 sensors and models into at least 3 separate energy management issues or decision support tools.

III. Energy Management Issues, Related Research, and Decision Support Tools

Potential Energy Management Issues: FY07-FY11

The Energy Management Program Element authorizes activities that contribute to the overall success of the Element through studies, working group participation, program reviews, and other endeavors.

Element Projects have a project manager who is responsible for the following:
• Leadership on project plans, development, performance, and partnership relationships
• Communication of project metrics, performance, status, and issues to Program Manager
• Leadership and communication to Energy Management Program Element team and network
• Management for assigned tasks, grants and cooperative agreements

The respective Project Managers are responsible for developing project plans and managing the activities to support the element, NASA's Earth Science Division, and its partners.

Priority Decision Support Tools

The following represent priority Decision Support Tools the program focuses on in the near-term.

RETScreen International

RETScreen is a decision support tool developed by Natural Resources Canada's CANMET Energy Technology Centre (NRCan/CETC-Varennes) with the contribution of numerous experts from government, industry, and academia. This clean energy project analysis software can be used worldwide to evaluate the energy production and savings, life-cycle costs, emission reductions, financial viability and risk for various types of renewable and energy-efficient technologies (RETs). NRCan/CETC-Varennes and NASA have developed a direct link to the SSE website to provide environmental parameters which improve the cost benefit analysis of these projects to international customers using RETScreen. http://www.retscreen.net/ang/menu.php

HOMER

HOMER is a computer model that simplifies the task of evaluating design options for both offgrid and grid-connected power systems for remote, stand-alone, and distributed generation applications. HOMER is developed by the Department of Energy National Renewal Energy Laboratory (NREL). An agreement is in place between NASA and NREL to support the improvement of the National Solar Radiation Database (NSRDB), which is significant for US exploration of solar renewable energy systems. http://www.nrel.gov/homer

Solar Sizer

Solar Sizer, developed by the Center for Renewable Energy and Sustainable Technology (CREST) and Solar Energy International, is a tool for the design of residential photovoltaic systems. http://www.crest.org

EPRI Neural Net Load Forecast Tool

The Electric Power Research Institute (EPRI) has developed a short-term (1-7 day) load forecasting decision support tool for the utility industry. EPRI is interested in improving this tool and in the development of longer term forecasting tools. Negotiations are ongoing to forge a partnership between EPRI and NASA to support these load forecasting tools by infusing observations derived from NASA observational spacecraft products. http://www.epri.com

National Energy Modeling System (NEMS)

The NEMS model represents energy supply, demand, and conversion sectors of domestic energy markets, plus international and macroeconomic modules. NEMS is a general equilibrium energy-economic model of U.S. energy markets with energy-related emissions. Emissions modeling includes energy system-wide carbon dioxide and methane emissions, with the capability to include carbon dioxide fees or caps, and emissions caps, trading, and banking of emission credits for carbon dioxide, sulfur dioxide, nitrogen oxides, and mercury in the electricity generation sector. http://www.eia.doe.gov

MiniCAM (Mini Climate Assessment Model)

The MiniCAM is a long-term, partial-equilibrium model of the energy, agriculture, and climate system. It contains an emissions model that considers both energy and land use emissions. Climate implications of scenarios and management strategies are readily available. It considers the full range of greenhouse gases and the major new alternative technologies that are pertinent to questions about the future structure of energy supply. The MiniCAM is used for modeling over long time scales where the characteristics of existing capital stocks are not the dominant factor in determining the dynamics of the energy system. MiniCAM scientists have expressed an interest in utilizing NASA datasets in their model inputs. Discussions are underway to develop

testbed scenarios for the rapid prototyping capacity. http://www.pnl.gov/gtsp/research/minicam.stm

IV. Project and Activities

The Energy Management Program Element conducts projects to support the program's goal and objectives. The projects fall into three types: Solicited Projects, Directed Projects, and Congressionally-Directed Acitities. The respective Project Managers and teams are responsible for developing project plans, managing the activities, and reporting issues and results. Generally, the projects involve the following activities:

Develop and nurture partnerships with appropriate organizations;
Identify and assess partners' energy management responsibilities, plans, and decision support tools and evaluate capacity of Earth science results to support the partners;
Validate & verify application of Earth science results with partners, including development of prototypes;
Cooperate with partners to document the performance and value of Earth science results relative to partners' benchmarks and to support adoption into operational use; and,
Communicate results & partners' achievements to appropriate energetic communities and stakeholders.

Plans, status, and results for each project are available through: http://aiwg.gsfc.nasa.gov

A. Solicited Projects

All National Applications Program Elements authorize peer-reviewed projects to support each element's goal and objectives. To secure funding and authorization to undertake activities supporting NASA and the Applied Sciences Program, project teams are responsible for developing project plans and managing the activities. The project plans specify the Earth system observations, models, and other research results to extend to decision support tools as well as the activities to produce appropriate deliverables. The plans integrate contributions from appropriate the partners, NASA Centers and other contributors from the community of practice. Projects are expected to extend the benefits of NASA research results to the maximum extent possible, including the use observations from sensors on: Aura, Terra, Aqua, TRMM, NPP, NPOESS, Hydros, Topex, Jason, OCO and Aquarius.

Project: Improving DST and Decision-Making Processes for Renewable Energy Planning and Assessment Using NASA Earth Science Data and Modeling Results — Solicitation

The purpose of this project is to assess the potential for NASA measurements relevant to solar, wind, and hydroenergy applications to improve the performance of United Nations Environment Programme (UNEP)'s SWERA II decision support system used in energy management policy and siting decision making for renewable energy resource assessement.

The Solar and Winder Energy Resource Assessment (SWERA) decision support system was designed to foster the devlopment of clean energy to minimize the risk of climate change and to improve energy security. This project will enhance the existing SWERA DSS by serving countried beyond the original 13 nations targeted, deriving hydropower assessments, and closely coupling the NASA data product streams with renewable energy analysis and investment toolkits, such as HOMER and RETScreen.

Budget ($K)

FY07	313
FY08	321
FY09	347
FY10	?
FY11	0

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
Richard Eckman LaRC		FY07 - FY09	USGS, DOE NREL

Principal Investigator(s): *Eugene Fosnight / USGS*

Earth Science Products

mission: *TRMM, GPM, SRTM, CERES, ERBE, FlashFlux*
sensor:
products:
models:

Other Apps.

Water Management

Deliverables

Description	*End Date*	*IBPD Metric #*
Project Plan	10/1/2006	
Evaluation Report	10/1/2007	
Design & Implementation		
Verification & Validation	10/1/2008	
Benchmark Report	10/1/2009	

Project funded under DECISIONS ROSES-05 solicitation

Notes:

Project: Integrated Forecast Systems for Mitigating Adverse Space Weather Effects on the Northern American High-Voltage Power Transmission System — Solicitation

The purpose of this project is to assess the potential for NASA space weather measurements to improve the performance of EPRI's SUNBURST decision support system used in modeling the transmission of plasma and magnetic fields and their dynamics from the solar surface to the Earth's ionosphere for forecasting ground-induced currents (GIC) that may affect the North American power transmission system.

The goal of this project is to enhance the Electrical Power Research Institute (EPRI) Sunburst decision support tool by prototyping a ground-induced current forecasting system for the effects of solar activity on the North American power grid. The forecasting system will consist of a chain of models, which transmit plasma and magnetic fields and their dynamics from the solar surface and heliosphere, to the magnetosphere of the Earth, and then into the Earth's ionosphere. The induced currents within the power transmission system will be compared to measurements of the EPRI SUNBURST network for metrics, validation and verification analyses.

Budget ($K)

FY07	300
FY08	309
FY09	319
FY10	0
FY11	0

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
Michael Hesse GSFC		FY07 - FY09	EPRI

Principal Investigator(s): *Michael Hesse / GSFC*

Earth Science Products

mission: *ACE, SOHO, STEREO, WIND, GEOTAIL*
sensor:
products:
models: *EPRI Sunburst*

Other Apps.

Disaster Management

Deliverables

Description	*End Date*	*IBPD Metric #*
Project Plan	10/1/2006	
Evaluation Report	10/1/2007	
Design & Implementation		
Verification & Validation	10/1/2008	
Benchmark Report	10/1/2009	

Project funded under DECISIONS ROSES-05 solicitation

Notes:

B. Directed Projects

The program supports directed projects to serve issues of critical strategic and tactical importance, including near-term opportunities with potential for high-return in developing relationships with partner organizations and where timeliness is critical to maintain.

Project: Renewable Energy — Directed Project

This project seeks to improve the public and private capability for integrating NASA solar energy and global weather products into energy production systems. The project addresses the area of energy production solar incidence products through the use of the Surface meteorology and Solar Energy (SSE) prototype website which provides online over 200 satellite-derived meteorology and solare energy parameters. Multiple decision support systems are served: RETScreen, Hybrid Optimization Model for Electric Renewables (HOMER), and Solar Sizer. The project team also supports the National Solar Radiation Data Base (NSRDB), maintained by DOE NREL.

Activities planned for FY07 include the completion and release of SSE 6.0 with validation and documentation.

Procurement Budget ($K)

FY07	161
FY08	150
FY09	0
FY10	0
FY11	0

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
Paul Stackhouse LaRC		FY06 - FY08	DOE NREL, NRCan (Canada)

Principal Investigator(s): *Paul Stackhouse*

Earth Science Products

mission: *CERES, ERBE, ISCCP, SRB, SSE*
sensor:
products:
models: *FLASHFlux, GEOS, GMAO*

Other Apps.

Air Quality, Agricultural Efficiency

Deliverables

Description	*End Date*	*IBPD Metric #*
Project Plan	12/1/2006	
Evaluation Report	6/1/2007	
V&V Report	2/1/2008	
Benchmark Report	9/30/2008	
Results Conference		

Notes:

Project: Hydroelectric Energy

The project addresses the area of hydroelectric energy. Agriculture and electricity are dependent on water stored in reservoirs, particularly in the western U.S. Tidal and wave energy resource assessment may also be met by current and future NASA missions. Potential decision support systems to be served include RiverWare and the Pacific Northwest Regional Collaboratory Water Resource Forecasting system.

Procurement Budget ($K)

FY07	
FY08	
FY09	
FY10	60
FY11	80

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
TBD		FY10 - FY12	DOE

Principal Investigator(s)

Earth Science Products

mission: *GRACE, LDCM, Jason, TRMM, GPM, OSTM,*

sensor:

products:

models: *Global Reservoir and Lake Monitor, RiverWare*

Other Apps.

Deliverables

Description	*End Date*	*IBPD Metric #*
Project Plan	9/1/2009	
Evaluation Report	9/1/2010	
V&V Report	9/1/2011	
Benchmark Report	9/1/2012	

Notes:

Project: International Energy Agency (IEA) (Task 36 Solar Resource Knowledge Management) Focus Area: Energy Production — Directed Project

NASA is participating in the IEA task and support the objectives of the task listed below. This work is performed under the MOU with NREL and will use NASA datasets and expertise to add value to the standardization and structure of the products that will serve multiple countries. The objective of Task 36 is to provide further standardization, better data reliability and availability, and improved spatial and temporal coverage, with customized solar resource products, including reliable solar radiation forecasts, which are easily accessible to industry. Achieving these objectives would reduce the cost of planning and deploying solar energy systems, improve efficiency of solar energy systems by more accurate and complete solar resource information, and increase the value of the solar energy produced by solar systems.
Portions of this project will directly contribute to a GEO energy management demonstration project responding to the 2007-2009 GEO Work Plan.

Procurement Budget ($K)

FY07	182
FY08	180
FY09	150
FY10	130
FY11	0

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
Paul Stackhouse LaRC		FY06 - FY10	SUNY-Albany, DOE NREL, ESA

Principal Investigator(s): *Paul Stackhouse*

Earth Science Products

mission: SSE, ISCCP, SRB, GMAO, CERES
sensor:
products:
models: FLASHFlux

Other Apps.

Deliverables

Description	*End Date*	*IBPD Metric #*
Project Plan		
Evaluation Report	6/1/2007	
V&V Report	6/1/2008	
Benchmark Report	10/1/2009	

Notes:

Project: Climate Change Impacts on the Energy Sector — Directed Project

The goal of this activity is to evaluate, validate, and benchmark Earth science products, spacecraft measurements, and assimilation products for support of the Integrated Assessment Modeling community (e.g., DOE/PNL MiniCAM model), and those of other agencies. Changes in typical climatological paterns (i.e., temperature, precipitation, solar energy, wind energy) and their impact on energy supply and demand will be pursued (e.g., using the results of the GISS Model E).

A regional impacts on climate change prototyping project to develop sustainable energy datasets from climate simulation models, partnering with GISS, will be pursued in FY07 under the Rapid Prototyping Capability component of the Crosscutting Solutions program.

Procurement Budget ($K)

FY07	39
FY08	60
FY09	100
FY10	160
FY11	170

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
Paul Stackhouse LaRC	GISS, MSFC	FY07 - FY11	DOE PNL

Principal Investigator(s): *GISS (TBD)*

Earth Science Products

mission: CERES, GMAO GEOS, SSE, SRB
sensor:
products:
models: *MiniCAM, GISS Model E*

Other Apps.

Deliverables

Description	*End Date*	*IBPD Metric #*
Project Plan	1/1/2007	
Evaluation Report	10/1/2007	
V&V Report	10/1/2008	
Benchmark Report	10/1/2009	

Notes:

Project: Short/Mid-Term/Seasonal Solar Energy Forecasting — Directed Project

This project seeks to improve public and private capability for integrating NASA solar energy and global weather products into energy production and energy efficiency systems. The project addresses the area of short-term (1-2 day), mid-term (1 week-15 day), and seasonal energy forecasting products. In the near term, activities will include the assessment and development of methodologies for evaluating short-term solar energy resource forecasts from weather forecast output and the development of methodologies for evaluating seasonal solar energy resource forecasts with NASA's Seasonal to Interannual Prediction Project (NSIPP) models.

Procurement Budget ($K)

FY07	117
FY08	85
FY09	0
FY10	0
FY11	0

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
Paul Stackhouse LaRC	GSFC	FY06 - FY08	SUNY-Albany

Principal Investigator(s)

Earth Science Products

mission: *CERES, ERBE, ISCCP, SRB, SSE*
sensor:
products:
models: *FLASHFlux, GEOS, GMAO, NSIPP*

Other Apps.

Air Quality, Agricultural Efficiency

Deliverables

Description	*End Date*	*IBPD Metric #*
Evaluation Report	6/1/2007	
V&V Report	10/1/2007	
Benchmark Report	10/1/2008	

Notes:

Project: Supply and Load Forecasting — Directed Project

This project seeks to improve public and private capability for integrating NASA solar energy and global weather products for the optimization of energy generation to meet demand and for the purchase of lower cost power sources. Interaction with the power industry to define required prototype datasets will be pursued in the near-term.

The project will also evaluate the utility of using NASA earth science measurements to assess future land-use patterns and urban heat island effects on energy supply and load forecasting. This effort will be pursued in FY07 through the Rapid Prototyping Capability component of the Crosscutting Solutions program element.

Procurement Budget ($K)

FY07	0
FY08	0
FY09	80
FY10	100
FY11	140

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
Paul Stackhouse LaRC	MSFC	FY09 - FY11	EPRI, NOAA, Regional power providers

Principal Investigator(s): *MSFC (TBD)*

Earth Science Products

mission: *CERES, ERBE, ISCCP, SRB, SSE*
sensor:
products:
models: *ANNSTLF, HELM, GEOS, GMAO, NSIPP*

Deliverables

Description	*End Date*	*IBPD Metric #*
Evaluation Report	10/1/2009	
V&V Report	10/1/2010	
Benchmark Report	10/1/2011	

Other Apps.

Air Quality, Agricultural Efficiency

Notes:

Project: Energy Management Future Project Evaluation — Directed Project

Identify and evaluate NASA earth system science measurement, modeling products, and relevant decision support tools for future support of enhanced managment and policy decision, targeting organizations such as the Stanford Energy Modeling Forum (EMF), Asia Pacific Partnership for Clean Energy, the Electrical Power Research Institute, and the power industry. One goal of these studies will be to develop closer ties with energy model developers to devise pathways from NASA science results (e.g., GMAO GEOS and spaceborne measurements) to energy decision support tool inputs. Areas of focus include:

1. Hydropower forecasting (NASA snow and precipitation data)
2. Ocean energy assessment (off shore wind energy, tidal and wave energy)
3. Locating geothermal energy sources internationally
4. Post-disaster energy management (infrastructure assessment)

Procurement Budget ($K)

FY07	80
FY08	35
FY09	0
FY10	0
FY11	0

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
Richard Eckman LaRC		FY06 - FY08	SAIC RTP

Principal Investigator(s): *Fred Vukovich*

Earth Science Products

mission: *CERES, ERBE, ISCCP, SRB, SSE*
sensor:
products:
models: *FLASHFlux, GEOS, GMAO*

Other Apps.

Air Quality, Agricultural Efficiency, Disaster Management

Deliverables

Description	*End Date*	*IBPD Metric #*
Evaluation Reports	10/1/2007	
Web Site for NASA energy management related measurements	10/1/2008	

Notes: Element Objectives Supported Objectives 2, 3, 4

Project: Energy Efficiency

This project seeks to improve the public and private capability for integrating NASA solar energy and global weather products into energy efficiency systems. The project addresses the area of energy efficient environment buildings. The project team supports various industry groups such as the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and American Institute of Architects (AIA).

Near-term activities include the enhancement and release of a sustainable and energy efficient buildings prototype and continued interaction and parameter development with ASHRAE and DOE design manuals.

Procurement Budget ($K)

FY07	136
FY08	140
FY09	110
FY10	0
FY11	0

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
Paul Stackhouse LaRC		FY07 - FY09	ASHRAE, AIA

Principal Investigator(s)

Earth Science Products

mission: *CERES, ERBE, ISCCP, SRB, SSE*

sensor:

products:

models: *FLASHFlux, GEOS, GMAO*

Other Apps.

Air Quality

Deliverables

Description	*End Date*	*IBPD Metric #*
Project Plan	1/1/2007	
Evaluation Report	10/1/2007	
V&V Report	6/1/2008	
Benchmark Report	9/30/2009	

Notes:

Project: Bioenergy

Global demand for food, feedstock and bio-fuel crops is expanding rapidly due to population growth, increasing consumption of these products (especially in developing countries), and skyrocketing use of these crops to produce ethanol as a bio-fuel. Accurate ecophysiological crop models have been developed for many of the food and bio-fuel crops and serve as the back-bone in sophisticated DSS's. These DSS's are increasingly being used to address the balance between the need to increase production/efficiency and environmental concerns, as well as the impact of global warming on crop production.

The development of 1-degree global data products which combine the climatological data in the POWER project archive (http://earth-www.larc.nasa.gov/power), near real time (2 to 3 day lag) meteorological data from the Goddard Earth Observing System (GEOS) quick-look products, and global solar energy fluxes (4 to 7 day lag) produced via the NASA FLASHFlux project are employed to demonstrate the viability of using the resulting 1-degree resolution regional-to-global meteorological and solar radiation data products as inputs to agricultural based DSS's for improved production of food, feedstock and bio-fuel crops.

Procurement Budget ($K)

FY07	106
FY08	100
FY09	110
FY10	0
FY11	0

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
Paul Stackhouse LaRC		FY07 - FY09	USDA, University of Nebraska

Principal Investigator(s)

Earth Science Products

mission: *CERES, ERBE, ISCCP, SRB, SSE, Glory, OCO*

sensor:

products:

models: *FlashFlux, GEOS, GMAO*

Other Apps.

Agricultural Efficiency

Deliverables

Description	*End Date*	*IBPD Metric #*
Project Plan	12/1/2006	
Evaluation Report	10/1/2007	
V&V Report	6/1/2008	
Benchmark Report	9/30/2009	
Results Conference		

Notes:

Project: Distributed Energy Generation and Grid Integration

This project seeks to improve the public and private capability for integrating NASA solar energy and global weather products into energy production systems. The project addresses the area of distributed energy generation and grid intergration. NASA earth science measurements and models can help energy planners in the medium-term with predicting the output and timing from renewable distributed energy resources, ultimately supporting efficient grid operations and integration. Potential focus areas include solar, wind, and other renewables. Multiple decision support systems are served: RETScreen, Hybrid Optimization Model for Electric Renewables (HOMER), Solar Sizer, and the National Solar Radiation Database.

Procurement Budget ($K)

FY07	
FY08	
FY09	115
FY10	170
FY11	140

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
TBD		FY09 - FY11	

Principal Investigator(s)

Earth Science Products

mission: *CERES, ERBE, ISCCP, SRB, SSE, Calipso, Glory*

sensor:

products:

models: *FLASHFlux, GEOS, GMAO*

Other Apps.

Deliverables

Description	*End Date*	*IBPD Metric #*
Project Plan	9/1/2008	
Evaluation Report	9/1/2009	
V&V Report	9/1/2010	
Benchmark Report	9/1/2011	

Notes:

C. Congressionally-Directed Activities

The program oversees Congressionally-directed activities associated with energy management issues. The project teams for Congressionally-directed activities are responsible for developing, managing, and reporting on technically-credible and appropriately-budgeted projects aligned with the NASA Applied Sciences Program objectives. The Energy Management program team interacts with the recipients to align their activities appropriately and facilitates interaction with the program's partners and other investigators.

There are no congressionally directed activities for the Energy Management Program Element.

V. Program Management & Crosscutting Solutions Support

A. Program Management Activities

The Energy Management program conducts activities that contribute to the overall management, advocacy, and success of the program. Activities include studies and assessments in informal planning, interagency working group participation, publications and journal articles, support for conferences and workshops, program team meetings, and other related endeavors.

Project: Energy Management Long-Range Planning and Working Group Meetings — Project Management

This activity identifies emerging focus areas in the Energy sector and determines the applicability of current and next generation NASA earth sciences observations and models in enhancing decision support systems in these areas. The activity ensures that the Energy Management program element is aligned with administration and international policies and priorities, i.e., GEOSS, US GEO, CCSP, and CCTP. This activity provides a framework to transfer benchmarked NASA observations and predictions in the Energy sector. It also supports the publication of Energy Management element goals and objectives in energy sector journals and the organization of Energy Management working group meetings.

Procurement Budget ($K)

FY07	25
FY08	15
FY09	0
FY10	0
FY11	0

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
Richard Eckman LaRC		FY07 - FY08	Battelle, DOE Pacific Northwest Laboratory

Principal Investigator(s): *Erica Zell (Battelle)*

Other Apps.

Earth Science Products

mission:
sensor:
products:
models:

Deliverables

Description	*End Date*	*IBPD Metric #*
Project Plan		
Evaluation Report - Overview	10/1/2005	
Design & Implementation		
Verification & Validation		
Benchmark Report		
Evaluation Report - Focused	3/1/2006	
Working Group Meeting	3/1/2007	
Journal Article	3/1/2007	

Notes: Element Objectives Supported Objectives 1, 2, 3, 4, 5

Project: Energy Management Program Planning, Committees, Meetings

Support interagency (e.g., Climate Change Science and Technology Programs), national, and international (e.g., GEO Secretariat) working groups relevant to the areas of energy management and climate change. Activities include:
1. Coordination of CCTP measurements and monitoring working group activities on behalf of NASA chair.
2. Presentation of status of program element activities and future plans at select energy management and scientific conferences and engage/educate these communities on the potential utility of NASA spaceborne measurements, analyses, and models.
3. Support focused energy management workshops (e.g., GEO energy community of practice)
4. Participation in working groups and committees devising future energy management related priorities and plans (e.g., GEO secretariat).

Procurement Budget ($K)

FY07	15
FY08	35
FY09	35
FY10	35
FY11	35

Project Manager and Center	*Other NASA Centers*	*Timeframe*	*Partners*
Richard Eckman LaRC	GSFC, MSFC, SSC	FY07 - FY11	CCSP, CCTP, IEOS, GEO secretariat

Principal Investigator(s): *n/a*

Other Apps.

Earth Science Products

mission:
sensor:
products:
models:

Deliverables

Description	*End Date*	*IBPD Metric #*
AGU meeting presentation	12/13/200	

Notes:

B. Crosscutting Solutions Support

The program consists of functional elements that contribute to all of the National Applications activities. The intention is to have the performance of these functions leverage accomplishments, and therefore the apparent resource investment, to the greatest extent possible into the National Applications partnerships. These functions are: Geoscience Standards and Interoperability, Human Capital Development, Integrated Benchmark Systems, and Solutions Networks. Examples of leveraged activities are:

Integrated Benchmark Solutions

• A Rapid Prototyping Center is a proposed center at Stennis to support NASA and partners in testing and verification of Earth science results in decision support tools

• Transition from Research and Operations Network (R2O) is a network that focuses on systematically transitioning the results of research to operational uses.

FY07:

Rapid prototyping activities in bioenergy, regional impacts of climate change, supply & load forecasting.

FY08:

FY09:

FY10:

FY11:

Solutions Networks

The Energy Management program plans to work with the Solutions Network activity to identify research results that may be candidates for Integrated System Solutions and/or priorities for Rapid Prototyping activities in emerging focus areas such as bioenergy. The program expects to meet with Solutions Networks representatives on a quarterly basis to review the results that the representatives have identified.

DEVELOP

DEVELOP is a student-based program for rapidly prototyping solutions for state and local applications and helping students develop capabilities related to applied Earth-Sun science.

FY07:

Participation in DEVELOP summer project relating to energy management in the western U.S.

FY08:

FY10:

GIO

Earth Science Gateway is a "portal of portals" providing an access point through an Internet interface to all web-enabled NASA research results

FY07:

FY08:

FY09:

FY10:

FY11:

VI. Budget: FY07-11

The following table lists the Energy Management Program budget for FY2007 - FY2011:

Project	FY07 ($K)	FY08 ($K)	FY09 ($K)	FY10 ($K)	FY11 ($K)
Improving Decision Suppot Tools and Decision-Making Processes for Renewable Energy Planning and Assessment Using NASA Earth System	313	321	347	0	0
Integrated Forecast Systems for Mitigating Adverse Space Weather Effects on the Northern American High-Voltage Power Transmission	300	309	319	0	0
Renewable Energy	161	150	0	0	0
International Energy Agency (IEA) (Task 36 Solar Resource Knowledge Management) Focus Area: Energy Production	182	180	150	130	0
Climate Change Impacts on the Energy Sector	39	60	100	160	170
Short/Mid-Term/Seasonal Solar Energy Forecasting	117	85	0	0	0
Supply and Load Forecasting	0	0	80	100	140
Energy Management Future Project Evaluation	80	35	0	0	0
Energy Efficiency	136	140	110	0	0
Bioenergy	106	100	110	0	0
Distributed Energy Generation and Grid Integration			115	170	140
Hydroelectric Energy				60	80
Energy Management Long-Range Planning and Working Group Meetings	25	15	0	0	0
Energy Management Program Planning, Committees, Meetings	15	35	35	35	35
Total = $	**1474**	**1430**	**1366**	**655**	**565**

VII. Schedule and Milestones for Energy Management

Project	*Start Date*	*Deliverable*	*End Date*
Improving Decision Suppot Tools and Decision-Making Processes for Renewable Energy Planning and Assessment Using NASA Earth Science Data and Modeling Results	FY07	Project Plan	10/1/2006
		Evaluation Report	10/1/2007
		Design & Implementation	
		Verification & Validation	10/1/2008
		Benchmark Report	10/1/2009

Project	*Start Date*	*Deliverable*	*End Date*
Integrated Forecast Systems for Mitigating Adverse Space Weather Effects on the Northern American High-Voltage Power Transmission System	FY07	Project Plan	10/1/2006
		Evaluation Report	10/1/2007
		Design & Implementation	
		Verification & Validation	10/1/2008
		Benchmark Report	10/1/2009

Project	*Start Date*	*Deliverable*	*End Date*
Renewable Energy	FY06	Project Plan	12/1/2006
		Evaluation Report	6/1/2007
		V & V Report	2/1/2008
		Benchmark Report	9/30/2008
		Results Conference	

Project	*Start Date*	*Deliverable*	*End Date*
International Energy Agency (IEA) (Task 36 Solar Resource Knowledge Management) Focus Area: Energy Production	FY06	Project Plan	
		Evaluation Report	6/1/2007
		V & V Report	6/1/2008
		Benchmark Report	10/1/2009

Project	*Start Date*	*Deliverable*	*End Date*
Climate Change Impacts on the Energy Sector	FY07	Project Plan	1/1/2007
		Evaluation Report	10/1/2007
		V & V Report	10/1/2008
		Benchmark Report	10/1/2009

Project	*Start Date*	*Deliverable*	*End Date*
Short/Mid-Term/Seasonal Solar Energy Forecasting	FY06	Evaluation Report	6/1/2007
		V & V Report	10/1/2007
		Benchmark Report	10/1/2008

Project	*Start Date*	*Deliverable*	*End Date*
Supply and Load Forecasting	FY09	Evaluation Report	10/1/2009
		V & V Report	10/1/2010
		Benchmark Report	10/1/2011

Project	*Start Date*	*Deliverable*	*End Date*
Energy Management Future Project Evaluation	FY06	Evaluation Reports	10/1/2007
		Web Site for NASA energy management related	10/1/2008

Project	*Start Date*	*Deliverable*	*End Date*
Energy Efficiency	FY07	Project Plan	1/1/2007
		Evaluation Report	10/1/2007
		V & V Report	6/1/2008
		Benchmark Report	9/30/2009

Project	*Start Date*	*Deliverable*	*End Date*
Bioenergy	FY07	Project Plan	12/1/2006
		Evaluation Report	10/1/2007
		V&V Report	6/1/2008
		Benchmark Report	9/30/2009
		Results Conference	

Project	*Start Date*	*Deliverable*	*End Date*
Distributed Energy Generation and Grid Integration	FY09	Project Plan	9/1/2008
		Evaluation Report	9/1/2009
		V&V Report	9/1/2010
		Benchmark Report	9/1/2011

Project	*Start Date*	*Deliverable*	*End Date*
Hydroelectric Energy	FY10	Project Plan	9/1/2009
		Evaluation Report	9/1/2010
		V&V Report	9/1/2011
		Benchmark Report	9/1/2012

Project	*Start Date*	*Deliverable*	*End Date*
Energy Management Long-Range Planning and Working Group Meetings	FY07	Project Plan	
		Evaluation Report - Overview	10/1/2005
		Design & Implementation	
		Verification & Validation	
		Benchmark Report	
		Evaluation Report - Focused	3/1/2006
		Working Group Meeting	3/1/2007
		Journal Article	3/1/2007

Project	*Start Date*	*Deliverable*	*End Date*
Energy Management Program Planning, Committees, Meetings	FY07	AGU meeting presentation	12/13/2006

VIII. Program Measures

The Energy Management Management team uses performance measures to track progress, identify issues, evaluate projects, make adjustments, and establish results of the program element. The program's goal and objectives (Section II) state what the program intends to achieve. These measures help the team monitor progress within and across specific activities to ensure the program meets its goal and objectives. The management team analyzes these measures retrospectively in order to made adjustments proscriptively to the program approach and objectives.

The measures are in two categories: Program Management measures are internally focused to assess the activities within the program. Performance measures are externally focused to assess if the program activities are serving their intended purpose. In general, the Energy Management program element uses these measures to evaluate the performance of activities conducted and sponsored by the program, especially the projects. In addition, the Applied Sciences Program uses this information in preparing IBPD directions and PART responses.

Program Management Measures (Internally-focused):

Inputs:
1) Potential issues and DSTs identified for Energy Management - number, type, range
2) Eligible partners to collaborate with - number, type, range
3) Potential results/products identified to serve Energy Management - number, type, range;

Outputs:
1) Assessments or evaluations of DSTs - number, range
2) Assessments of Earth science results/products to serve DSTs - number, range
3) Agreements with partners - presence
4) Reports (evaluation, validation, benchmark) - number, type

Quality and Efficiency:
1) Earth science results/products - number used per DST, ratio of utilized to potential
2) Agreements - ratio of agreements to committed partners
3) Reports - partner satisfaction, timeliness, time to develop
4) Reports - ratio of validations to potential products, ratio of benchmarks to validations

Performance & Results Measures (Externally-focused):

Outcomes:
1) Earth science products adopted in DSTs - number, type, range; use in DST over time
2) Earth science products in use - ratio of products used by partners to reports produced
3) Partner & DST performance - change in partner DST performance, number and type of public recognition of use and value of Earth science data in DST

Impacts:
1) Partner value - change in partner metrics (improvements in value of partner decisions)

In addition to the stated measures, the Energy Management program periodically requests an assessment of its

plans, goals, priorities, and activities through external review. The Energy Management team uses these measures along with comparisons to programmatic benchmarks to support assessments of the Applied Sciences Program (e.g. internal NASA reviews and OMB PART). In specific, the Energy Management program uses comparisons to similar activities in the following programs (i.e., program benchmarks) to evaluate its progress and achievements (e.g., GEO energy management societal benefit theme and the Environmental and Societal Impacts Group at NCAR). The Energy Management program will report on its progress through various programmatic media (e.g., NASA websites, AIWG website, and Earth Science Gateway) and will publish articles in journals and trade media.

Appendix A: Program Element Partners

A. Program Management

Energy Management Element Program Manager:
Dr. Richard Eckman
Richard.S.Eckman@nasa.gov

Responsibilities:
• Program representation, advocacy, and issues to Science Mission Directorate management and beyond.
• Communication of Applied Sciences priorities and directives to Energy Management Element team/network
• Implementation of interagency agreements and partnerships
• Monitoring Energy Management Program Element metrics and performance evaluation

Energy Management Element Deputy Program Manager:
Dr. Paul Stackhouse
Paul.W.Stackhouse@nasa.gov

B. Energy Management Network & Partners

The program element maintains a network of organizations and points-of-contact associated with Energy Management activities.

NASA Centers:
NASA Langley Research Center
NASA Goddard Research Center
NASA Stennis Space Center

Federal Partners (Active):

Department of Energy, National Renewable Energy Lab
Point of Contact: Dr. David Renné
An agreement is in place between NASA and the Department of Energy's National Renewable Energy Laboratory (NREL) to support NREL's role in the development of energy related DSSs. This agreement includes the support of an improvement in the National Solar Radiation Database (NSRDB), which is vital for US exploration of solar renewable energy systems, and it allows for collaboration supporting NREL's work developing programs for energy efficient buildings and redistribution of energy (http://www.nrel.gov/).

Natural Resources Canada/CANMET Energy Technology Centre
Point of Contact: Gregory J. Leng
The Energy Management Program Element is developing an agreement with the Natural Resources Canada's CANMET Energy Technology Centre (NRCan/CETC-Varennes) to continue and expand current collaborations. NRCan/CETC-Varennes' clean energy DSS called RETScreen International is a project analysis software which is used by more than 90,000 professionals in 216 countries around the world to evaluate the technical and financial viability of various types of renewable and energy-efficient technologies (RETs). NRCan/CETC-

Varennes and NASA have developed a direct link to the SSE website to provide environmental parameters which improve the cost benefit analysis of these projects to international and U.S. customers, which includes investment agencies such as the World Bank.

Developing Partnerships:
Department of Energy (DOE) Energy Information Administration (EIA)
Collaboration with the Department of Energy Information Administration and the organizations that support the National Energy Modeling System (NEMS) will be critical to enhance the use of NASA products in the NEMS modules such as the Renewable Fuels Module. Discussions with DOE EIA personnel are underway to forge this pathway.

Environmental Protection Agency (EPA)
Office of Atmospheres Program
Negotiations and collaborations with the EPA personnel responsible for models, which impact energy production, are underway to forge pathways of predicted parameters for energy sector use.

National Oceanic and Atmospheric Administration (NOAA)
Negotiations and collaborations with the NOAA modeling to forge pathways of predicted parameters for energy sector use.

United States Department of Agriculture (USDA)
Partnerships with the USDA to support Energy Production scenario assessments using biomass are targeted through an existing agreement with the USDA and NASA.

United States Department of State
Negotations and collaborations with State Department Bureau of Oceans and International Environmental and Scientific Affairs personnel to forge pathways for the utilization of NASA datasets relevant to energy production in the developing world.

Electric Power Research Institute (EPRI)
Negotiations are ongoing to forge a partnership between the EPRI and NASA to support EPRI's load forecasting DSS. EPRI has developed a short-term load forecasting DSS for utilities. EPRI is interested in improving this DSS and in developing longer term forecasting tools.

Other organizations (presenting additional partnership opportunities)
Western Governors Association (WGA),
Aerospace States Association (ASA),
American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE)
American Institute of Architects (AIA)

Solar and Wind Energy Resource Assessment (SWERA)
SWERA is a United Nations Environment Programme (UNEP) project to provide solar and wind resouce data and geographic information assessment tools to developing countries for renewable energy projects. NASA satellite-derived datasets are actively used by DSTs participating in this project.

G8 Gleneagles 2005

The G8 Gleneagles Plan of Action (July 2005) addressed climate change, clean energy, and sustainable development. Activities in the Energy Management element align closely this international initiative.

World Summit on Sustainable Development (WSSD) 2002
The WSSD Plan of Implementation addressed topics in renewable energy and energy efficiency. Energy management element activities align with many elements of the Implementation Plan.

International Energy Agency (IEA)
A task addressing the standardization, enhanced data reliability, and availability of solar resource products which are easily accessible to industry and government entities, responding to GEOSS objectives, was recently approved by the IEA. Energy element program researchers are participating in this work.

Pacific Northwest National Laboratories (PNNL)
PNNL researchers have expressed interest in utilizing NASA data products for inclusion in their energy integrated assessment models, MiniCAM and PG CAM. Discussions are underway to define needed datasets.

The Energy Management Program Element performs evaluation research in the areas of energy production, energy efficiency, measuring and monitoring of greenhouse and other gases, and carbon sequestration as related to the energy sector, to develop new partnerships through the program element activities described below.

DAACS and Earth Science Modeling Centers:

NASA Langley Atmospheric Sciences Data Center (ASDC)

The NASA Surface Meteorology and Solar Energy (SSE) dataset, a component of the POWER project, is hosted by the Langley ASDC. The SSE dataset is used by the RETScreen, HOMER, and Solar Sizer decision support tools. A direct interface between SSE and RETScreen exists, facilitating the use of this NASA product in the evaluation of the energy production, life-cycle costs, and greenhouse gas emission reductions for various types of energy efficient and renewable energy technologies

NASA Science Mission Directorate
Earth Science Division - Applied Sciences Program
Energy Management Program Element

This document contains the Energy Management Program Element Plan for FY 2007-2011.

This plan derives from direction established in the NASA Strategic Plan, Earth Science Enterprise and Space Science Enterprise Strategies, Earth Science Applications Plan, and OMB/OSTP guidance on research and development. The plan aligns with and serves the commitments established in the NASA Integrated Budget and Performance Document.

The Program Manager and the Applied Sciences Program Leadership have reviewed the plan and agree that the plan appropriately reflects the goals, objectives, and activities for the Program Element to serve the Applied Sciences Program, Earth Science Division, NASA, the Administration, and Society.

Dr. Richard Eckman
Program Manager, Energy Management
Applied Sciences Program
NASA Earth Science Division

Date

Lawrence Friedl
Lead, National Applications
Applied Sciences Program
NASA Earth Science Division

Date

Teresa Fryberger, PhD.
Director, Applied Sciences Program
NASA Earth Science Division

Date